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An
Inaugural Dissertation
on the
Proper means for resuscitating the apparently dead
from drowning.

Submitted to the examination
of the
Trustees and Medical Professors
in the
University of Pennsylvania.

1813

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Gentlemen.

With much diffidence I submit the following dissertation to your inspection. The subject it comprises is unquestionably an important one; and I have no doubt, that both time and talents have been wanting to do it justice.

Of very many inscriptions in the succeeding pages, I am fully conscious, nor can I doubt that there are many more which will not escape your superior discernment. Yet I feel some confidence in believing, what I have said will be regarded with that lenity and candour, which ever distinguish the noble heart and enlightened mind. My highest expectation will be answered, if by your decision I am enabled to say

Vitae domique culsum.

Now laudandum meum.

In treating the subject of this dissertation I have previously to laying down the proper means for resuscitating the apparently dead from drowning, described the common effects of drowning; then briefly enquired how the water acts in producing these effects, and afterwards, to throw some light on the indications of death, taken a slight view of the nervous influence excited on the lungs in respiration. My description of the common effects of drowning, is taken from Coleman; it agrees pretty generally with that given by all the writers on the subject, whose works I have had an opportunity of consulting.

Common effects of drowning.

As soon as an animal is immured in water, air is expelled from its lungs and immediate attempts are made apparently with great difficulty, to inspire in which a small quantity of water is taken in. The animal breathes increasingly unceasingly, again expels air and takes in water. The duration of this process

* See his inaugural address.

varies from one minute to four, when the muscles of respiration cease to act and all struggling is at an end. Some involuntary motions, however, generally succeed. On opening the chest, we find the two venae cavae, right sinus venosus, auricles, ventricles and pulmonary arteries loaded with blood; the left auricle nearly distended with blood, the left ventricle about half, the aorta and its branches containing a quantity of blood, which in all its appearances resembles venous. The lungs are found in a state of collapse containing a small quantity of water, in the form of froth, but very trifling when compared to the quantity of air expected from the lungs during the act of drowning. The stomach, on examination presents also a little water, which probably passed into the oesophagus when the rima glottidis was closed by the epiglottis; for as the water contained in the mouth is then refused admittance into the trachea, it should seem, that at that moment, it makes its way into the stomach; so that, as soon as the animal attempts to respire, water enters the trachea; but this organ, as if conscious of not receiving its due element, rejects the water, which is then allowed to pass into the oesophagus. Air is again admitted, and new efforts made to inspire, when upon the same sensations being produced, similar efforts arise; and after the last inspiration, no more water enters the lungs or stomach.

Soder Osweat* thinks the water does not enter the lungs, in drowning, during the efforts made to inspire, but after they have ceased; and indeed his experiments go far towards a confirmation of this opinion.

Colomar continues "The heart has frequently been observed to continue, or more properly to vibrate for more than two hours after respiration was suspended, and that from no other stimulus, but its own blood, while in other experiments the vibrations did not continue one tenth part of that time. The right side of the heart preserves its actions much longer than the left, and the auricles much longer than their corresponding ventricles."

"The peristaltic motion of the intestines does not continue as long as the circulation

* See Godfrey's Essay on the connexion of life with respiration.

contractions of the heart, and on opening the head, the veins as in ordinary death are found rather distended, but without the least appearance of extravasation.*

I shall now briefly enquire how the water acts in producing the effects just described. Does it act directly by entering the cavity of the lungs, or indirectly by excluding air from them? That a portion of water does enter the lungs of an animal when submersed, either during its effort to inspire, or very soon after those efforts have ceased, is a fact well established; but that the quantity of water thus taken in, is insufficient to destroy life, I think, is very satisfactorily proven by a set of experiments instituted by Doctor Gooding, for the purpose of ascertaining the fact. He first very ingeniously ascertained the quantity of fluid taken into the lungs in drowning, by confining animals submersed in Mercury, until they ceased to exhibit signs of life; it was then easy, after removing them, to determine the precise quantity of this fluid in the lungs, as the quicksilver remained unmixed with the fluid contained in them in a healthy state, a circumstance which gives Mercury the preference to every other fluid in making these experiments. After having ascertained the quantity of fluid taken into the lungs in drowning, the Doctor, in order to discover whether that alone was sufficient to produce death, injected a quantity of water equal to the sum of the fluids (the Mercury and natural mucus of the lungs) found in the lungs of the decomposed animals, through an opening made in the trachea of other animals which were in a healthy state. This produced no other symptom than a difficulty of breathing and a feeble pulse; both of which were soon abated and the animals lived several hours afterwards without much apparent inconvenience, when they were strangled.*

Thus it appears that, the water which enters the lungs of an animal after submersion is not sufficient to produce the changes which

takes place in drowning, and that these changes must be occasioned immediately by the exclusion of air from the lungs.

I shall not enquire into the particular effects, either chemical or mechanical, which the air exerts on the lungs in respiration. The most true in Physiology is well acquainted with the fact that respiration and of course life, cannot be supported without oxygen. Exclude an animal, by any means, from this vital element, and death sooner or later will be the inevitable consequence. Whether oxygen gives irritability to the system, whether it is absorbed into the blood for other purposes; or whether it acts by decomposing the venous blood, which it meets with in the lungs without being absorbed at all, I shall not attempt to determine. For my purpose it is sufficient to know, that without it life cannot be continued. A knowledge of this fact leads to one of the most important in decisions for constituting the expeditious, dead from drowning, of the proper treatment of whom I am presently to speak. But to render that air may perform its proper office in the lungs, whatever that may be, it is necessary the influence of the nerves over those organs be duly exerted.

That respiration in a healthy state is under the influence of the nerves distributed to the lungs; under that of the brain, whence the many are derived, is I think, clearly demonstrated by some very interesting experiments of Mr. Despagnet. This gentleman divided the eighth pair of nerves in a number of horses and dogs and found this division always mortal: compression of the nerves if continued any time, produced the same effect, it was soon more speedily fatal. — The animals submitted to these experiments, exhibited all the appearances of asphyxia produced by a non respirable, but not deleterious gas; the blood in the arteries and veins becoming of a rusty black.

Death appears to take place in these cases, in consequence of the action of the lungs being suspended and rest from the suspension

* See a paper read by M. Buffon, chief of the anatomical department in the medical school of Paris to - translated for & published in *Eclat's Repository*, Vol. I. Num. III.

was used and so regulated as to be sufficiently con-
tinuous that the animal could be made to pass from life to appa-
rent death. In this way the path of the vessels was
followed and the influence of the air determined to be
in the air vessels the oxygen of the air is absorbed
by the blood.

Various diagnostic marks have been laid down, to distinguish the disease brought on by submersion from those caused by other causes, but the following are the most important:—

I return now to the considerations of cause and the
means of getting them. They are,
1st a return to the blood, and it is a healthy quality and a
strong life by getting to the normal condition of supp-
lemental blood in order that the blood may be
supplied with oxygen indispensable to the animal economy.
The first of the means is to get the blood. Getting the blood can
be done in a number of ways, but the best is to give the heart and blood vessels
a rest and to let the heart and blood vessels
have a chance to get rid of the bad blood.

* Various modes of applying Heat have been recommended
the warm bath, covering the patient with heated sheets &c.
These in general take up too much time in their preparation
- and too frequently the application of the warmth,

seen or else under the skin. It is to be noted that the skin with a vacuum blanket is not to be used for the degree of a suitable degree of cooling of the body parts to be occasionally turned. It is also to sufficient location of the skin to the circulation in the blood vessels.

17. It is a instrument to be applied to the nose
18. It is a instrument of glass containing the two
separate cavities, in such manner, that by expanding them when
applied to the nostril or mouth of a person, one cavity is to be filled
19. The common name of it is a nostril dilator
20. The age of it is not mentioned
21. The use of it is to dilate the nostrils
22. The material of it is glass
23. The size of it is not mentioned



* The author of "Martyrdom of a Slave" is unknown.
The author of "A Slave in the South" is unknown.
The author of "A Slave in the South" is unknown.
The author of "A Slave in the South" is unknown.

See William W. Gilmore.

the lungs as possible. If the animal is not dead, it is necessary to stop the respiration, and some measure be introduced.

Now unable to inflate the lungs in any of the ways above, it is necessary to contract a spasm of the muscles, the animal is to be turned so that it immediately performs another lungs respiration, the opening of the wind pipe. At the same time it is necessary to give galvanic shocks should be passed alternately through the heart and the brain; in order to promote the nervous influence to the lungs. It is necessary to repeat this until it is known that the lungs are well inflated, and that a galvanic current passes through the heart, and that a galvanic flame passes through the very heart.

The galvanic is one of the most powerful agents we possess in exciting the nervous system and producing convulsions. See that it is reasonable to expect great advantage from this. For the loss of air is of great importance when the animal is exhausted. Fortunately in most cases of suspended respiration it is in a considerable degree of excitement. In such cases of resuscitation, the heart should never be omitted, when the apparatus necessary can be used. Animals which were apparently dead have been restored by its influence alone.*

It has been supposed by some that the heart is not susceptible of the galvanic influence; but we are very much mistaken. By the name of Aystew, Vesali, Sandi, and G. and

others, it is known that the heart is susceptible of the galvanic influence.

* Doctor. - and J. B. Brown's inaugural disputation

which does not injure the stomach. The various impressions
thrown into the body, friction and particular stimuli applied to the nose
are as follows.

In the stomach is the best of agents to be used
systemically, and as impressions made upon it are so readily passed to
the other parts, much relief may be expected from the introduction
of medicines into it. These should be sent to stimulate us to act for us
and powerfully, as ether, Volatile Alkalies and other spirits.
Liquor or these articles will be found to answer the purpose as well
and it has the advantage of being a needle at hand. These may be
be very conveniently injected into the stomach by means of a syringe
and a tube which is to be introduced into the mouth. If the
of this kind be not at hand, they may be advantageously
brought a needle with a syringe the patient's hand being a little
into a warm (but not hot) paper into the stomach. From a
is necessary, as will be sufficient to inject at once; if the patient
wishes to remain at home, the can be left in the stomach
as long as desired. As far as the nervous system, it would prove
to be the best to be dissolved in it. The efficacy of
the various impressions to these introductions, the wall
of the stomach is the best. They may be introduced by means of a

stiletto or a short blunt needle. These
should consist of some warm aromatic; these should not be too strong
so as much to distract the bonds, which would be injurious to power
easy descent of the diaphragm. Hence the impropriety of using strong
essences. It has been suggested by a writer on this subject that as
the medicine sent into the intestines might do good by in
a strong state, it had better be sent into the

... it would good might result from the employment of this, would
be counterbalanced by their mechanical hazard. I need say nothing of
the injury which the English have done to their country by their
relaxed commitment to war; judicious, etc. For an account of the de-
leterious effects of this article when used in cases of susp. etc. and
refer the reader to the inaugural dissertation of a Mr. L. J. Fox

Fractures are of great importance in the "not bony".
They affect in favor of the blood & the lymphatic vessels and a
short time stimulates the new growth. One measure of great
value would set out in any mode of case will answer the purpose
well. When a mite substance of this kind is used the
longer, the better it is of excretion. It is a common
rule all along, as far as a constant and permanent growth
will be prevented when acids substances are present.

It is to be seen in Paris to-day in
the Louvre, and it is the most
beautiful object in the collection.



begin to return, we shoudt delay our operations and proceed with the utmost circumspection. By overrating our part at this critical juncture, we might lose one of the highest pleasures attending the exercise of our profession, and have the severe mortification of seeing our patient perish, at the very moment we began to fancy our endeavours crowned with success. I cannot better enpup the line of practice we are to pursue, in the momentous stage of our patients recovery, just alluded to, than in the words of Dr. Armstrong.

While the vital fire
Burns feeble, heap not the green fuel on;
But gradually ferment the wond'ring spark
With what the soonest feels feels its kindred touch:
Be frugal now of that; a little goes a long way;
At first; that kindles, add a little more;
Till by deliberate nourishing the flame
Rises, with all its wonted vigor and glow.

The precise time at which our attempts to restore the unfortunate objects of our attention, shoudt cease, cannot well be laid down; in general they shoudt be continued at least four hours - Whilst there is yet reason to believe the faintest spark of life remains, we shoudt not despair of being able to fan it into perfect animation. Nothing shoudt induce us to omit our endeavours, whilst the remotest possibility of preventing a fellow creature from being prematurely banished into eternity, remains. Do we fail? we have the consoling reflection of having done all that duty and humanity required - Are we successful - our reward more than equals every exertion. Who would not rejoice at bringing back to life and spontaneity, the poor wretch,

who has essayed to put an end to the horrors of guilt, or despair, by a violent grieve — Where the bosom that resists not that with pleasure next to divine, at being the instrument of restoring to helpless and dependent family their comfort and support; by snatching from the evil dominions of death, the kind husband and affectionate father.

As we respect the duty of man to man and of man to his God — as we judge the feelings of a self approving conscience, we will persevere in our attempts to resuscitate the apparently dead from des-
tiny —

